The Unknown. CAMILLE FLAMMARION. New York and London, Harper & Brothers, 1900. Pp. xii + 488. $2.00.

Brief Guide to the Commoner Butterflies of the Northern United States and Canada. SAMUEL HUBBARD SCUDDER. New York, Henry Holt & Co., 1899. Pp. xi+210.

Commercial Organic Analysis. ALFRED H. ALLEN. P. Blakiston's Son & Co., 1900. Vol. II., Part II. Pp. viii+330.

Inorganic Evolution as studied by Spectrum Analysis. New York and London, The Macmillan Co., 1900. Pp. x+191. $1.75.

SCIENTIFIC JOURNALS AND ARTICLES.

THE March number of the *Bulletin of the American Mathematical Society* contains the following articles: 'Mathematical instruction in France,' by Professor James Pierpont; a review, by Professor E. W. Brown, of Poincaré's Cinématique et Mécanismes, Potential et Mécanique des Fluides; 'Shorter Notices'; 'Notes'; and 'New Publications. The April number of the *Bulletin* contains a report of the February meeting of the Society, by the Secretary; 'Some theorems concerning linear differential equations of the second order,' by Professor Maxime Bôcher; 'Note on the enumeration of the roots of the hypergeometric series between zero and one,' by Dr. M. B. Porter; 'The summer meeting of the Deutsche Mathematiker-Vereinigung, at Munich, September, 1899,' by Professor James Pierpont; reviews of Hilbert's Grundlagen der Geometrie, by Dr. J. Sommer, and of König's Leçons de Cinématique, by Professor E. O. Lovett; 'Notes'; and 'New Publications.'

THE *Journal of the Boston Society of Medical Sciences* for March 20th, is largely devoted to abstracts of the papers read at the first meeting of the Society of American Bacteriologists, held at New Haven, Dec. 27–30, 1899. Several of these dealt with the question of purification of sewage and contamination of water supply. Charles S. Minot has a paper 'On the Solid Stage of the Large Intestine in the Chick, with a Note on the Ganglion Coli.' W. T. Councilman discusses 'The Lobule of the Lung and its Relation to the Lymphatics,' and Thomas Dwight notes a case of 'Absence of the Inferior Vena Cava below the Diaphragm.'

SOCIETIES AND ACADEMIES.

THE NATIONAL ACADEMY OF SCIENCES.

THE annual stated session of the National Academy of Sciences was held in Washington, April 17–19, 1900, with Dr. Wolcott Gibbs in the chair, and the following members in attendance: Messrs. Abbe, Agassiz, Allen, Barus, Beecher, Bell, Billings, Boss, Brewer, Brooks, Brush, Chandler (S. C.), Chittenden, Comstock (G. B.), Dall, Dana, Dutton, Elkin, Emmons, Farlow, Gibbs (W.), Gilbert, Gill, Hague, Hall, Hill (G.W.), Langley, Mitchell (S. W.), Morse, Powell, Putnam, Remsen, Rowland, Schott, Smith (E. F.), Walcott, Welch, White and Wilson.

The resignation of Dr. Wolcott Gibbs as President of the Academy was reluctantly accepted to take effect at the close of the session. His successor will be elected at the next April sess sion.

Six additional members of the Council were chosen for the ensuing year, as follows: Messrs. J. S. Billings, H. P. Bowditch, G. J. Brush, Wolcott Gibbs, Arnold Hague, Simon Newcomb.

The following gentlemen were elected members of the Academy: James E. Keeler, Director of the Lick Observatory, Mt. Hamilton, Cal.; Henry F. Osborn, of Columbia University, New York City; Samuel L. Penfield, of Yale University, New Haven, Conn.; Franz Boas, of Columbia University, New York City.

The Academy adopted a report from the Trustees of the Barnard Medal recommending that the medal be awarded to Wilhelm Conrad Röntgen for his discovery of the X-rays. This medal is awarded at the close of every quinquennial period to such person as shall, within the five years next preceding, have made such discovery in physical or astronomical science, or made such novel application of science to purposes beneficial to the human race, as, in the judgment of the National Academy of Sciences of the United States, shall be esteemed most worthy of such honor.

Mr. Agassiz offered to give to the Academy

the sum of $5000 to be a part of a contribution to a building fund to erect a building for the use of the Washington Academy of Sciences and the local or affiliated societies, on condition that the land needed for such a building be given by the Government or obtained from other sources, and furthermore, that the sum of $100,000 at least be raised for that purpose, and that the National Academy of Sciences have such privileges granted as they may need.

Mr. Agassiz also offered to give $1000 towards a general fund for the National Academy of Sciences, provided that $20,000 be raised for that purpose. Mr. Theo. Gill offered to donate $500 to the general fund. These offers were accepted by the Academy, and committees will in due time be appointed to obtain subscriptions to these funds.

The following papers were read in the scientific session:

I. 'The Anatomy of *Nautilus pompilius*': L. E. Griffin. (Introduced by W. K. Brooks.)

II. 'West Indian Madreporarian Polyps': J. E. Duerden. (Introduced by W. K. Brooks.)

III. 'On the Use of Electric Motors, of the Shunt Type, for Solving Linear Differential Equations of any Order with Variable Coefficients': Reginald A. Fessenden. (Introduced by Cleveland Abbe.)

IV. 'On the Prediction of the Physical Properties of the Pure Metals': Reginald A. Fessenden. (Introduced by Cleveland Abbe.)

V. 'A Partial Explanation of some of the Principal Ocean Tides': Rollin A. Harris. (By permission of H. S. Pritchett. Introduced by Cleveland Abbe.)

VI. 'Secondary Enrichment of Sulphides in Ore Deposits': S. F. Emmons.

VII. 'The Cruise of the U. S. Fish Commission Steamer *Albatross* in South Seas, August, 1899, to March, 1900': A. Agassiz.

VIII. 'On the Zoogeographical Relationships of Africa': Theodore Gill.

IX. 'Report of the Watson Trustees on the Award of the Watson Medal to David Gill': Simon Newcomb.

X. 'A Human Bone from the Glacial Deposit at Trenton, N. J.': F. W. Putnam.

NEW YORK ACADEMY OF SCIENCES. SECTION OF ASTRONOMY, PHYSICS AND CHEMISTRY.

A meeting of the Section was held on Monday evening, April 2nd. Professor William Hallock, of Columbia University, discussed the overtones of a tuning fork. The first regular overtone of a tuning fork is about two and a half octaves above the fundamental, but Lord Rayleigh pointed out that when the amplitude of the vibration became so great that the restoring force was no longer proportional to the displacement, the octave appeared, as indicated by theory. Lord Rayleigh recognized the presence of the octave with his ear, and by the use of a resonator. Professor Hallock obtained direct evidence of this effect by means of a photograph of a manometric flame, the capsule of which was resting against the prong of the fork.

In a paper on 'Specific Gravity Weighings,' Professor Hallock spoke of a number of points in which the ordinary operations can be improved. It is very convenient to use the principle of the Jolly balance, in which there is a pan always immersed, to hold the body when weighing it in water. The effect of capillarity on the supporting wire, which at best lessens the sensibility of the balance, can be avoided by sending a series of little waves across the surface of the water while weighing. To get rid of bubbles in little corners of irregular bodies, these bodies may be held under the tap at the sink and moistened with water before immersion, or still better, they may be moistened with alcohol and then with water before immersion.

Professor M. I. Pupin of Columbia University, described a new faradmeter which he had devised, an instrument for measuring the capacity of a condenser. This instrument is essentially a Wheatstone's bridge using alternating currents, in which one leg of the bridge consists of two resistances in series, and the other leg consists of two capacities in series, one of the two being that of a standard condenser, the other being the unknown capacity to be measured. In the bridge connecting the two points, one between the two resistances, the other between the two capacities, is a telephone. If the two separate circuits each containing one of the two capacities, are arranged so that the capacity reactance is by far the greatest part of the impedance in that circuit, then silence in the telephone will be obtained

when the two resistances are to each other inversely as the two corresponding capacities. The apparatus has been employed in the Columbia University laboratory and gave complete satisfaction. It is capable of a tolerably high degree of accuracy, but its principal merit is its convenience.

Professor J. K. Rees presented a paper by Miss C. E. Furness on a 'Catalogue of stars within one degree of the North Pole, and the optical distortion of the Helsingfors astrophotographic telescope.' The paper gave the results of measurements on 65 stars. By taking stars near the pole, the same group of stars can be taken at different angles with reference to the object glass of the telescope. At Helsingfors the pole is sufficiently far from the horizon to avoid trouble with refraction. From the measurements the distortion of the Helsingfors lens was found to be not appreciable.

WM. S. DAY,
Secretary.

TORREY BOTANICAL CLUB.

AT the meeting of the Club on February 28th the first subject on the scientific program was a 'Note on Apeiba,' by Dr. D. T. MacDougal, who showed specimens of leafy branches of this Tiliaceous tree, exhibiting flowers apparently seated on the leaves, an accidental but frequently quite stable position, due to abundant blossoms dropping from above, piercing the lower leaves and lodging there. Dr. MacDougal witnessed this peculiarity in trees cultivated in Jamaica, originally from British Guiana.

The principal paper of the evening was a discussion by Dr. N. L. Britton 'On the Flowering Plants collected by Mr. R. S. Williams in the Yukon Territory, 1898–1899.' Dr. Britton exhibited the plants collected, and by means of a sketch map of the region he compared the diverse floras of the Alaskan region. Mr. Williams' collection contains several new species and several others which are new to North America. The Ferns, Lycopodia, etc., of Mr. Williams' collection were reviewed by Dr. Underwood and Professor Lloyd. They include such widespread forms as *Cystopteris fragilis*, *Polypodium vulgare*, *Selaginella rupestris*, and species of *Equisetum* and of *Lycopodium*, including *L. annotinum*, and *L. Selago*. The Conifers include *Tsuga Mertensiana*. Dr. Britton is still engaged on a study of the similarly abundant Sedges, with several peculiar forms. *Carex vesicaria* is there cut for hay. *Eriophorum vaginatum* and *E. polystachyon* grow there also. The eight orchids were worked over by Dr. Rydberg.

The Birches are interesting, one of them new to North America. Another new birch has just been described from the Alaskan coast, but this is wholly different. Two *Polygonum* species occur, *P. viviparum*, and another peculiar to Alaska. *Rosa acicularis* occurs there, and one violet, *V. Macloskiei*. The Buffaloberry, *Shepherdia*, is there a shrub; *Cornus Canadensis*, *C. stolonifera*, *Empetrum nigrum*, etc., are present. Only three Umbelliferæ were collected. An important part of the flora is formed by the Heath family, about 20 species, *Dodecatheon* is there, *Primula Sibirica*, a *Gilia*, two species of *Polemonium*, a new *Mertensia;* only one Labiate; *Gentiana propinqua; Menyanthes trifoliata; Plantago aristata; Galium boreale; Linnæa borealis; Viburnum pauciflorum;* a new Valerian, etc. On the whole the flora is not so fully Arctic as we might have expected from the latitude.

Mr. R. S. Williams, the collector of these specimens, said there were few shrubs there except willows; for miles all is covered by spruce 15 to 20 feet high and not over two or three inches in diameter. A detailed discussion of the Forest-conditions of the Klondike will be furnished by Mr. Williams to an early number of the *Journal of the New York Botanical Garden.* Mr. G. N. Nash said there were 36 species of Grasses, 7 new, and some others new to North America, as *Calamagrostis Lapponica* and *Festuca altaica.* Professor Lloyd spoke of the interesting forms of *Lycopodium complanatum.* One in Montana and Idaho is irregular in habit, and has one spike on a peduncle. The Klondike specimens seem to be the Arctic condition of this Montana form and so agree with others from Labrador. EDWARD S. BURGESS,
Secretary.

SCIENCE CLUB OF THE UNIVERSITY OF WISCONSIN.

THE March meeting of the Science Club of the University of Wisconsin was a memorial

session in honor of the late John Eugene Davies, a charter member of the Club and for more than thirty years a professor in physics in the University. From 1877 to 1890 Mr. Davies was in charge of the Wisconsin work of the United States Coast and Geodetic Survey. The base line of three miles which he measured, and upon which the triangulation system of the southern part of the State is based, has stood as a model of accuracy. Addresses were made by J. B. Parkinson, who gave a biographical sketch of Mr. Davies; by B. W. Snow, who spoke of physics in the University previous to 1891; by W. W. Daniells, who spoke of the sciences in the early days; by L. S. Smith, who discussed the work on the Coast and Geodetic Survey, and by A. S. Flint, whose subject was Dr. Davies' connection with the Washburn Observatory. At the close of the meeting the following resolution was unanimously adopted by a rising vote:

"In the death of Professor Davies the University has lost another of those teachers whose devoted services in the years following its reorganization were the foundation of its present prosperity. In the earlier years of his professorship he was obliged to teach many subjects and only to elementary classes. Yet in the distraction of these multifarious tasks, imposed by the necessities of a struggling institution, his love for the higher ranges of scholarship in his own department remained clear and strong. Throughout a professorship of more than thirty years he welcomed with eager interest every advance in mathematical physics and was in full appreciative sympathy with the development of that science, even in its remoter aspects. He loved his science for its own sake and was successful in imparting to his chosen students his own interest and pleasure in its pursuits. His kindly and serene personality endeared him to his associates, whether in the faculty or among the students. They desire by this minute to record their feelings of the loss in his death, both to themselves and to the University in whose service he spent his life."

A REGULAR meeting of the Club held March 22d, was devoted to a symposium on the microscope and its use in the various departments of science. The following program was presented: Construction of the compound microscope and its use in physics, B. W. Snow; its use in general biology, E. A. Birge; in cytology, R. A. Harper; in bacteriology, H. L. Russell; in chemistry, S. M. Babcock; in petrology, Wm. H. Hobbs; and in engineering, J. G. D. Mack. An exhibition of the different types of instrument and of accessory apparatus served to illustrate the subjects presented.

WILLIAM H. HOBBS.

CHEMICAL SOCIETY OF WASHINGTON.

THE 116th regular meeting was held Thursday, February 8, 1900.

The following program was presented:

J. K. Haywood—'The Adulteration of the Arsenical Insecticides.'

C. A. Crampton and F. D. Simmons—'Uncompounded Chemicals under the War Revenue Act' (with exhibition of specimens).

Wirt Tassin—'The Relation of the Chemical Society to the Municipality.'

F. K. Cameron—'The Genesis of Hardpan.'

The 117th regular meeting was held Thursday, March 8, 1900.

The program was devoted to a symposium on Iron and Steel, as follows:

Iron—The raw material; chemistry of iron-ore smelting, cast iron, properties of iron.

Steel—The raw materials, converting methods, the mill, castings, forgings and plates, special steels.

The participants were Messrs. Dewey and Tassin.

WILLIAM H. KRUG,
Secretary.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

AT the 516th meeting of the Society held March 31st at the Cosmos Club, Mr. Marcus Baker read an obituary notice of Samuel Shellabarger. Mr. H. S. Davis, by invitation, described the present 'State of Progress on the New Reduction of Piazzi's Observations.' This paper appeared in the issue of SCIENCE for April 13th. Mr. Alexander Macfarlane's paper on 'Vector Differentiation' was summarized and presented by Mr. Radelfinger, and finally Mr. Wead discussed the discontinuity in functions arising from an infinite exponent, and the use of such discontinuous functions to limit the range of a given equation: *e. g.*, to the surface within a circle and outside a square; to the black squares of a checkerboard; to the surface of a parallelopipedon, etc. The title

of the paper was 'On certain Discontinuous and Indeterminate Functions.'

E. D. PRESTON.
Secretary.

DISCUSSION AND CORRESPONDENCE.

REQUEST FOR CO-OPERATION IN WORK ON THE COMING SOLAR ECLIPSE, ETC.

THERE is a very singular phenomenon observed during the moments immediately preceding and following total solar eclipses, that has, up to the present time never been satisfactorily explained so far as I know. Just before totality, usually about a minute before, alternate bright and dark bands are observed sweeping across the country. These have been called shadow bands by some observers, and diffraction bands by others. They can be observed to the best advantage by laying a large piece of white cloth on the ground.

In some eclipse reports they are styled 'Diffraction bands bordering the moon's shadow.' Fringes bordering a shadow should, however, move with the speed of the shadow. Observations show that the dark bands move quite slowly, from ten to twenty feet per second, while the shadow of the moon rushes across the country at cannon ball speed. Moreover, they move in one direction before the eclipse, and in the opposite direction after. The only half way plausible explanation that I have ever heard offered for the shadow bands is that they may be due to striæ in the atmosphere. This would bring them under the head of the scintillation phenomena treated of somewhat extensively in advanced works on optics, but I am unable to see how any such regular and symmetrical distribution of light and shade can result in this way. That the distance between the bands varies on different occasions lends some plausibility to this explanation, but it is not impossible that the width of the bands is a function of the location of the point of observation, that is to say of its distance from the center of the eclipse track. This can only be determined by numerous and extensive observations covering a wide tract of country, and it is to secure as many data as possible on this subject that I desire to secure the co-operation of all who are interested in the subject. Observations just outside of and just within the track of totality will be of especial interest. The observations can be made without any apparatus, and as the bands are not visible during totality, their observation will not inconvenience any who are more interested in the spectacular than in the scientific side. At the end of this article I shall outline as clearly as possible just how the observations should be made, and what data recorded. It has occurred to me that the stroboscopic disc may be of use in determining the cause of the bands. If a source of light produces in any way, moving bands of light and shade, it is obvious that if the eye be directed towards the source, it will receive more light from the source while a bright band sweeps across it, than during the transit of a dark band. If the alterations are not too rapid a fluctuation in the brilliancy of the source should be observed.

As a matter of fact, citing a special case, the bands are about three inches wide, and move with a velocity of about ten feet per second. This means that forty bands cross the eye every second, too many to cause any flickering effect. By means of a stroboscopic disc, which is merely a circle of cardboard with equidistant radial slits arranged to be rotated at varying speeds, it is possible to keep the eye in a dark or light band as long as we choose.

Suppose we are looking at the source of light through the slits of the revolving disc, and suppose that the speed of rotation is such that the slits cross the eye at the same rate that the dark and light bands do. This is practically keeping the eye continually in a dark or light band. If the rotation is a little faster or a little slower, the slits will alternately get into, and out of step with the bands, and the eye will be in a bright band one moment, and in a dark one the next. In this way we may make the speed of the fluctuations as slow as we please, and if we look at the sun's crescent through such a device we may possibly detect a flickering in whatever part of the source of light is operative in producing the bands. The disc should be about a foot in diameter with about eight slits in it, distributed uniformly. I should advise that three or four concentric rings of slits of different width be made, the eye being moved from one